What is claimed is:

1. A method of manufacturing a semiconductor device, comprising the steps of:

(a) providing an insulation layer on a semiconductor substrate, the insulation layer containing oxygen atoms and having a predetermined portion exposed; and

(b) forming a metal oxide layer having a predetermined thickness on the exposed surface of the insulation layer by subjecting the semiconductor substrate to a metal precursor having reactivity with oxygen.

2. The method of claim 1, wherein the insulation layer is a TiO_2 layer, a SiO_2 layer, a Ta_2O_5 layer, an Al_2O_3 layer, a $BaTiO_3$ layer, a $SrTiO_3$ layer, a (Ba, Sr)TiO_3 layer, a $Bi_4Ti_3O_{12}$ layer, a $PbTiO_3$ layer, a PZT((Pb, La)(Zr, Ti)O_3) layer, a ($SrBi_2Ta_2O_9$)(SBT) layer or a compound layer of some of them.

3. The method of claim 1, wherein the step (a) is a step of forming a capacitor comprising a lower electrode, a capacitor dielectric layer and an upper electrode on the semiconductor substrate, and the insulation layer is the capacitor dielectric layer.

4. The method of claim 1, wherein the step (a) comprises the sub-steps of:

forming an interlayer insulation layer wrapping a predetermined conductive region on the semiconductor substrate and containing oxygen atoms; and

forming an opening exposing the conductive region by patterning the interlayer insulation layer, the insulation layer being the interlayer insulation layer.

5. The method of claim 4, wherein the conductive region is the upper or lower electrode of a capacitor, a gate electrode, a bit line, a word line, or the lower conductive line of a multi-layered interconnection layer.

6. The method of claim 1, wherein the step (b) is performed by an atomic layer deposition method using the metal precursor and inert gas as pulsing gas and purge gas, r spectively.

7. The method of claim 6, wherein the step (b) comprises the sub-steps of:

pulsing the metal precursor over the entire surface of the semiconductor substrate; and

purging the entire surface of the semiconductor substrate, which has been subjected to the pulsed metal precursor, using inert gas.

8. The method of claim 7, wherein the step (b) is a step of repeating a cycle until the metal oxide layer is formed to a desired thickness, the cycle being a series of steps comprising the metal precursor pulsing step and the inert gas purging step.

9. The method of claim 1, wherein the metal precursor contains Al, Ta, Ti, Zr, Mg, Ce, Y, Nb, Hf, Sr or Ca.

10. The method of claim 1, further comprising the step of thermally treating the metal oxide layer in an oxygen atmosphere after the step (b) to stabilize the metal oxide layer so that the dielectric characteristic of the metal oxide layer can be enhanced.

11. The method of claim 10, wherein the thermal treatment step is performed using a rapid thermal process or a furnace type thermal process.

12. The method of claim 3, further comprising the steps of:

thermally treating the metal oxide layer; and

forming an encapsulating layer of an oxide layer containing metal, the encapsulating layer wrapping the entire surface of the capacitor, after the step (b).

13. The method of claim 12, wherein the encapsulating layer is formed by an atomic layer deposition method using a metal precursor and oxygen source gas as pulsing gas and inert gas as purge gas.

14. The method of claim 13, wherein the step of forming the encapsulating layer comprises the steps of:

pulsing a metal precursor over th entire surface of the semiconductor substrate;

purging the entire surface of the semiconductor substrate, which has been subjected to the pulsed metal precursor, using inert gas;

pulsing oxygen source gas over the entire surface of the semiconductor substrate which has been purged with the inert gas; and

purging the entire surface of the semiconductor substrate, which has been subjected to the pulsed oxygen source gas, using inert gas.